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Procedia - Social and Behavioral Sciences 90 (2013) 235 – 244

Procedia
Social and Behavioral Sciences

6th International Conference on University Learning and Teaching (InCULT 2012)

Mobile Learning Application for Basic Router and Switch Configuration on Android Platform

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Abstract

This paper presents the design and development of Mobile Learning Application for Basic Router and Switch Configuration on Android Platform using Java Programming Language to help students in computer networking courses at the Department of Computer Technology and Networking, Faculty of Computer and Mathematical Sciences, University of Technology Mara, Malaysia. Our approach is to incorporate multimedia animations concept with command langguage to create the pervasive learning environment in presenting the Router and Switch Configuration systematically. With this mobile learning application, student could learn at his or her own pace, anywhere and anytime. This mobile learning application intends to complement the current traditional classroom and e-learning systems. Initial testing has shown that a well-presented multimedia animations capability that is delivered through a mobile phone has a great potential to promote and enhance learning process.

Keywords: Android Platform, Java Programming Language, Mobile Learning Application, Router and Switch Configuration

1. Introduction

The use of computing technology for learning has been observed in various ways. In the past few decades, electronic learning or e-learning had been adopted and used by public schools and university students in many parts of the world. They were familiar with both the e-learning terminology and technology but in recent years, the rapid progress in mobile technology has created a new area which is known as mobile learning. Mobile learning is the next generation of e-leaming that are based on mobile devices (Sharples, M.,2005). Wireless technologies such as IEEE 802.11, Bluetooth, and GPRS are used in a project for development of informal

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doi:10.1016/j.sbspro.2013.07.087

classroom and *eSchoolbag* system at the Aletheia University in Taiwan (Chang C., Sheu J., 2007). A pilot case study called Math4Mobile was conducted in a novel environment to support mobile learning (Botzer, G., 2007). The Math4Mobile environment includes cellular applications designed to support mathematics learning. In conclusion, the study shows mobile learning enhances the students' experiential learning.

The main steps in development of a distributed mobile learning application for Android presented by P. Pocatilu, F. Alecu and M. Vetrici (2010). The client application communicates with the server using Web services. The prototype developed includes the testing module. Using Web services for mobile learning applications helps the process of development by providing a standardized way of communication between mobile clients and servers. ere is a research on how to use mobile devices and mobile application development as a mechanism to teach introductory programming to computer science students (Mahmoud, Q.H and Popowicz, P.,2010). The objective of their research is to integrate mobile devices into computing education that could provide more benefits to the students than other teaching techniques. In their research the approach involves Java Micro Edition (ME) platform and the Blackberry smartphone as a device. The application associated software tools such as Blackberry Java Development Environment for building Java ME and Blackberry based applications and Blackberry Smartphone Simulator.

There is a project from University of Tennessee at Martin that has developed mobile learning applications for the Google's Android and Apple's iOS platforms to be used in electrical engineering courses will be investigated their effects on student performance. These applications are quiz style and touch based applications that ask students questions relevant to electrical engineering subjects. There are several different problems to choose from, including digital logic gate analysis, discrete signal convolution, and digital filter design. Once students complete the work, the score results can be sent to the instructor's email automatically (Potts, J, Moore, N and Sukittanon, S., 2011).

2. System Design and Development

Fig. 1 shows the general design of the system.

Fig. 1. System Design

2.1. Hardware and Software Requirement

The following are the hardware requirements needed to develop this application:

- Personal Desktop/Laptop has been used to develop this application and all software will be installed for the development process. The minimum memory size required is 1GB in order to be able to run or execute the application successfully.
- Server to store this application and for content delivery that the developer needs to upload the Basic Router and Switch Configuration content to the database. Mediafire file hosting is chosen to store this application. User will easily download the application from this hosting site if they want to use the application. Smartphone is a mobile phone that offers more advanced computing ability and connectivity than a contemporary basic feature phone.
- Mobile phones and features phones may be thought of handheld computers which are integrated within mobile telephones. For this project Samsung Galaxy was used because it can support Android platform which this application was developed.

The following are the hardware requirements needed to develop this application:

- Android is a mobile operating system developed by Google and is based upon a modified version of Linux kernel. The Android operating system software stack consists of Java application running on a Java based object oriented application framework on top of Java core libraries. The Android SDK includes a comprehensive set of development tools for developing an application for mobile phones that support Android platform.
- Eclipse is the platform upon which the plug-in runs and it focused on building an open development platform comprised of extensible frameworks, tools and runtime for building, developing and managing software.
- Eclipse is a software that can be used to write program such as Java programming language to develop mobile applications. The platform consists of open source software components tool that vendor use to construct solution that plug-in into integrated software workbenches.
- Adobe Photoshop is a graphics editing software that developed and published by Adobe Systems. This software used to make the background interface for this application. It is the current market leader for commercial bitmap and image manipulation software.

2.2. Setting up Laptop Computer

There are several phases that are needed to setting up Laptop Computer such as:

- Installing and Configuring Eclipse with Android ADT And AVDs to prepare the development computer and ensure it meets the system requirements. After that install the SDK starter package for windows because operating system used is Windows 7. Developer needs to add packages that going to be used for the development to the SDK. The packages need to be installed from Android SDK Manager before application can be developed.
- The next step is to install Eclipse. Eclipse can be suitably adapted for Android development since developer can get plugins to help with creating Android project. There a few versions of eclipse, developer used Eclipse IDE for java Developer for this project development.
- After that Android Development Tool (ADT) needs to be installed. To install this, open eclipse and choose from help than click “Install New Software”. Then click the “Add” button and create a new entry: Name: “Android ADT” (this space is for your own personal use) and Location: https://dl-ssl.google.com/android/eclipse/. Check all the boxes to install all the tools then just click “I agree”, “Next”, “Yes” and wait until it asks to restart eclipse.

- Last but not least, developer need to create Android Virtual Devices (AVDs) that will be the emulator for running and testing the Android application project on the computer. In the same "Android SDK and AVD Manager" choose "Virtual Devices" on the left and create "New" ones. Different AVDs will represent different Android Version as well as different hardware specifications and screen densities.

2.3. Setting up the Server

There are several phases that are needed to setting up the Server such as:

- Firstly, an account needs to be registered before the application can be uploaded and stored in mediafire file hosting database. Registration form needs to be complete before can proceed to the next steps.
- To upload the application file to the database drag only android application file (.apk) and wait until the uploading process completed. The download link will automatically be generated by the file hosting. Clicked on share link and it will direct to the generated link. User can get this mobile learning application by downloading it using this link.
- The content delivery development process is completed when the android application package (.apk) can be accessed by the developer in the database. Only developer can make changes to the file in the database.

2.4. Setting up Mobile Phone

There are several phases that are needed to setting up Mobile Phone such as:

- Developer needs to make sure the mobile phone is all ready to be installed with the application when the development process ends. This involves checking a few settings and making sure the mobile phone is set into the right way then connecting the mobile phone to the computer with USB cable which is already setup and configured. To get the phone ready to work, there are several steps need to be followed which are:
- Tap the "home" button and go to phone's home screen.
- Tap the "menu" button on the home screen than click "setting" than click "Applications".
- If the phone has an unknown sources setting, make sure the unknown sources checkbox are checked.
- Tap "Development" and make sure both USB Debugging and Stay Awake checkbox are checked.
- Finally, connect USB cable from the mobile phone to the computer which is already installed and configured before.

2.5. Mobile Learning Modules

There are several design phases that are needed to show the flow of this application. The prototype developed consists of five activities: Flowchart, Context Diagram, use case diagram, Storyboard, and Content Delivery Framework.

The prototype of mobile learning application storyboard has the following modules:

- The main module menu of the application. User may click on any preferable choices. The choices are shown below.
- The introduction module about this application and some details about the developer for user to know.
- The components module needed to make simple network connection before user can do basic configuration on router and switch. When user clicks each component there will be explanation for each component.
- The tutorial module that will provide step by step process on how to do basic configurations on router and switch. All basic configuration commands will be shown here so user can easily learn how to implement them

later.

- The configuration module helps the users to reinforce their knowledge by practicing the basic switch and router configurations from what they have learnt in the tutorial module. This module could be used as an assessment to gauge the users understanding on the subject matter.
- About us module contains the profile of the project members.

This system used the content of the textbooks provided by Cisco (Wendell Odom, 2011). The modules are written independently, and they share the common data. Each module has an associated screen and they are launched from a main screen.

3. Testing and Results

To test this application, developer used mobile phone Samsung Galaxy S with Firmware Version (2.3.4 – GINGERBREAD) that runs Android platform. The user can download this application through internet using their cellular or WiFi.

Fig. 2. Content Download Page

Fig. 2 shows the download page when user wants to download and uses this Mobile Learning Application for Basic Router and Switch Configuration. User will entered download link to download the application which is *http://www.mediafire.com/?v6msmbm3t15o3ss* and the above page will appeare. Click on the download button and the application will download automatically tothe user mobile phone.

The installer package file can be found inside downloads folder inside the mobile phone which transferred from the file hosting. To install this application click on Basic Network.apk file this is the Android package file used to be installed as shown in fig. 3a. Next screen as shown in fig. 3b will appear after clicking on the Android package file. User will be asked whether want to install this application or not. Click on install button to proceed to the installation process and click cancel to terminate the installation. After clicking install the application will be install. Installation progress screen appear and will be shown on the next screen as shown in fig. 3c. Wait until the installation process completed about a few minutes before the application can be used on mobile phone.

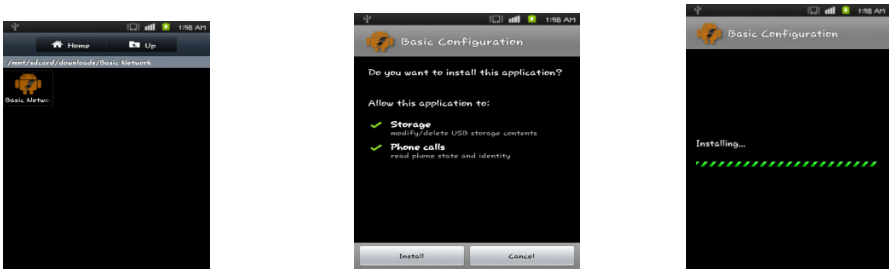

Fig. 3. (a) Basic Network.apk file; (b) Android packege file; (c)Installation Process

After the installation process is completed, go to mobile phone main screen as shown in fig. 4a and there is an application icon label Basic Configuration on the main menu that shows that the application has been installed. Click on the icon and user can start using the application. This is the final stage, all the tasks such as installation and configuration of this application are done. At this phase the application needs to be tested to ensure the functionality of the application runs correctly and find any defects that occurs. This application tested by the stakeholder and the result are filled in the given testing and result form. The detail about the testing and result for the configuration module in this application will be explained as follow.

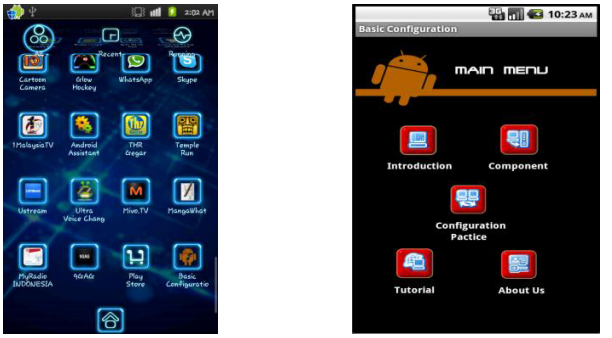

Fig. 4. (a) Main screen of Application ; (b) Main menu of Application

To start using the application., click on the icon label Basic Configuration on the main screen in Fig. 4a. Main menu of Application will appeare as shown in fig. 4b.

Click on the Configuration Practice in Main menu of Application in fig. 4b, user will be given Addressing table and topology before doing the configuration task as shown in fig. 5a. User needs to follow the ip address, subnet mask, and default gateway given from addressing table for the configuration.

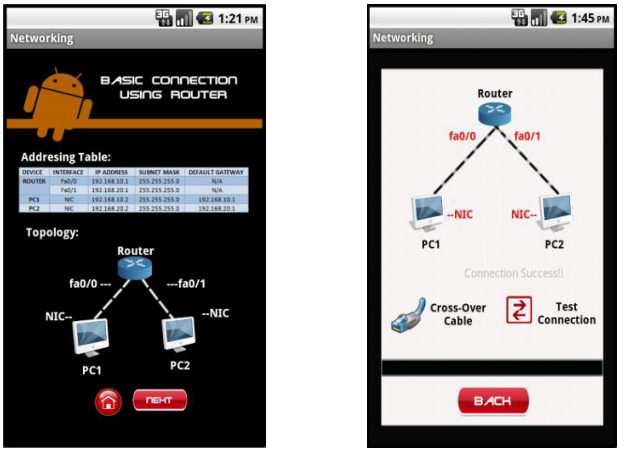

Fig. 5.(a) Task for user to configure; (b) Simulation Screen

User clicks the next button to enter the simulation screen. On the simulation screen there is Router, PC1, PC2, Cross-Over Cable, and test connection button task as shown in fig. 5b. User needs to click on Cross-Over Cable then fastethernet0/0 and fastethernet0/1 will appear. Choose fastethernet0/0 then click on the router and connect

it to PC1. Apply the same step, click on fastethernet0/1 then click on the router and connect it to PC2.

To Configure PC1 and PC2 with the information given in the addressing table before, user needs to click on the PC1 to enter PC1 menu configuration as shown in fig. 6a. Now user clicked on PC2 the menu configuration for PC2 appeare as shown in fig. 6b. Same step as PC1 applied, user needs to setup the ip address, subnet mask, and gateway for PC2. For PC2 the ip address entered is 192.168.20.2, subnet mask is 255.255.255.0, and gateway is 192.168.20.1. After that click apply to save the data entered before and back to the simulation screen. The Router Command Line Interface configuration as shown in fig. 6c will appeared when user click on the router icon in simulation screen.

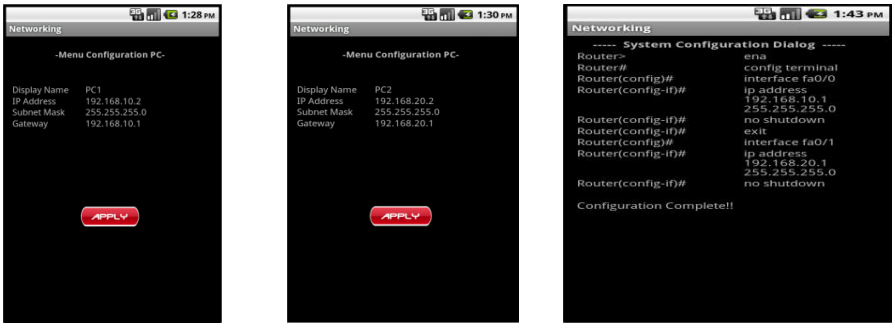

Fig. 6. (a) Configuration PC1; (b) Configuration PC2 ; (c) Router Command Line Interface

This is CLI for the router which user needs to do the configuration on the router. After the cable connected from the router to both PCs using fastethernet0/0 and fastethernet0/1 user needs to do configuration. Firstly, user type *ena* to enter the privileged mode of the router. In the privileged mode, user type *config terminal* to enter the configuration mode of the router. User needs to setup the configuration for fastethernet0/0. Type *interface fa0/0* to enter fastethernet0/0 interface. The ip address entered by the user for this interface is 192.168.10.1 and 255.255.255.0 for the subnet mask. To make sure the interface is up, user entered *no shutdown* command. Now user needs to set up the configuration for fastethernet0/1, but before that *exit* command applied to exit from fastethernet0/0 interface. In the router configuration mode type *interface fa0/1*to enter fastethernet0/1 interface. The ip address entered for this interface is 192.168.20.1 and 255.255.255.0 for the subnet mask. Then *no shutdown* command entered to make sure the interface is up. Finally, after the entire configuration on the router completed the Configuration Complete massage will appeared. Type the *end* command to exit the CLI and back to the simulation screen.

After all configurations are completed on the router and both PC1 and PC2, user need needs to test the connection by clicking on the Test Connection button simulation screen. Connection Successful message will appeare on the screen if the connection between the router and PCs success. But, Connection Failed message will appear if the connection failed. If Connection Failed message appeared the user can do the trobleshooting.

To start troubleshooting, Click on the Troubleshoot Testing

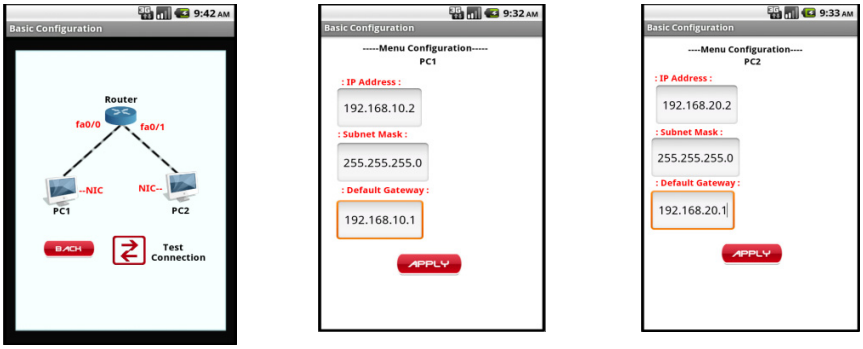

Fig. 7. (a) Simulation screen; (b) PC1Troubleshoot; (c) PC2Troubleshoot

Fig. 7a shows the topology given for the troubleshoot practice. For this troubleshoot both PCs and router are set with incorrect ip address, subnet mask, and default gateway which made the connection failed. User needs to troubleshoot and correct the errors based from the routing table given to make the connection successful.

For PC1 incorrect ip address which is 192.168.10.1 and subnet mask 192.168.10.10 as shown in fig. 7b. User corrected the errors using the correct ip address and subnet mask which is 192.168.10.2 for ip address and 192.168.10.1 for subnet mask. After all errors are corrected user click on apply button to save the changes made and return to troubleshoot simulation. For PC2 incorrect ip address given which is 192.168.20.1 and subnet mask 192.168.20.5 as shown in fig. 7c. User corrected the errors using the correct ip address and subnet mask which is 192.168.20.2 for ip address and 192.168.20.1 for subnet mask. Click on the apply button to save the changes made before and return to troubleshoot simulation.

The fig. 8a appears when user clicked on the router. It showed the incorrect ip address and subnet mask have been entered on the router. User needed to correct the incorrect ip address and subnet mask. To make the changes clicked edit button to enter CLI Troubleshoot to make configuration change as shown in fig. 8b.

There is text filed for user to enter the correct configuration in fig. 8c and then click enter button for each command entered. Firstly, user type *ena* to enter the privileged mode of the router. The *config t* command entered to enter the configuration mode of the router. Entered fastethernet0/0 interface using *int fa0/0* command and entered the correct ip address which is 192.168.10.1 and 255.255.255.0 for the subnet mask.

After that, type *int fa0/1* to enter fastethernet0/1 interface and entered the correct ip address which is 192.168.20.1 and 255.255.255.0 for the subnet mask. After the changes have been made clicked apply button to save the configuration and return to troubleshoot simulation.

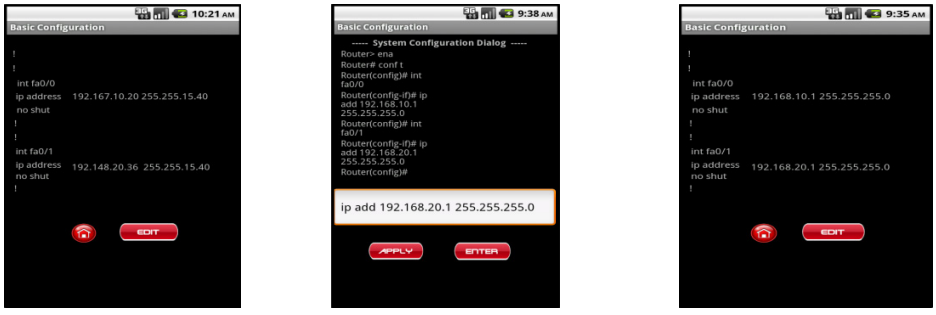

Fig. 8. (a) Wronged data entered; (b) CLI Troubleshootp; (c) Correct data after troubleshoot

After all changes have been made and saved user can click once more on the router to check if the configuration has been changed. Fig. 9 below show that the correct ip address and subnet mask have been made on the router compare to before.

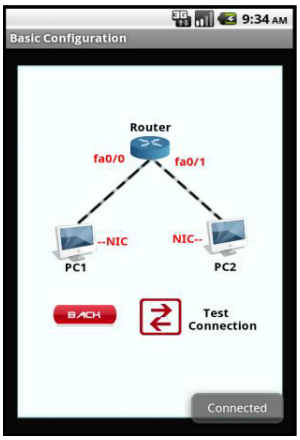

Fig. 9. Test the connection

Lastly, when all corrections have been made users need to check if the connection between both PC1 and PC2 to the router is successful or not. User clicks on test connection button and when the connection is successfully connected, a message will appear on the screen as shown in the fig. 9 above.

4. Conclusion and Future work

The development of mobile applications is not an easy task. In this paper we presents the main steps in development of a mobile learning application for Android. The client application communicates with the server using Web services to download the application. The system developed includes the testing module. The testing result showed that the system worked correctly.

Next step, we are going to conduct an evaluation on the prototype to assess the learning efficiency and effectiveness of this system. This system will persist to grow and the future work will include improving the content of the system by adding more modules and multiple choice questions, creating more assortments of interactive learning options for the system, continuous enhancement of the system to continuously suit the students' needs and further experiments will be conducted for a longer period of time.

Acknowledgements

This study was supported by the UiTM Research Excellence Fund (Faculty Intensive Research) Grant Scheme, Research Management Institute, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia, under grant No. 600-RMI/DANA 5/3/RIF (61/2012).

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